



Curriculum

Field of study: Electronics and Telecommunications

General characteristics of the field of study

Basic information

Faculty name:	Faculty of Computer Science, Electronics and Telecommunications
Field of study:	Electronics and Telecommunications
Level:	First-cycle (engineer) programme
Profile:	General academic
Form:	Full-time studies
ISCED classification:	
Number of ECTS credits necessary to complete studies at a given level:	210
Professional title awarded to graduates:	inżynier
Cycle start date:	2024/2025, winter semester
Duration of studies (number of semesters):	7

Field of science to which the field of study is assigned:

Field engineering and technical sciences

Discipline of science to which the field of study is assigned:

Discipline	Percentage	ECTS
Automation, electronic, electrical engineering and space technologies	71%	149
Technical computing and telecommunications	29%	61

Relationship between the field of study and the AGH University development strategy and the AGH University mission

A general academic profile of first-cycle and second-cycle studies at the Faculty of Computer Science, Electronics and Telecommunications constitute an attractive educational offer for people seeking employment in the IT sector. Education includes the acquisition of specialized directional skills and social competences. Thanks to carefully prepared and updated education programs, the studies prepare well for professional work, opening the way to professional and social promotion. In the graduates' opinion, studies in this field are: a source of satisfaction from own achievements and a sense of belonging to the community of engineers - graduates of a renowned technical university. The AGH development strategy imparts a clear mark on the Electronics and Telecommunications curriculum, it should be mentioned here: (1) improving and diversifying the educational offer, (2) increasing the knowledge, skills and social competences of the graduate, (3) supporting student activity, (4) preparation for professional and social activity, (5) activities stimulating research at the highest level, (6) expanding the educational skills in English, (7) supporting innovative and implementation activities through the development of cooperation with the economy.

Information on taking into account the socio-economic demand while creating the curriculum and indication of the assumed learning outcomes matching the identified demand

The development of the information society requires staff qualified in both the use of technically and technologically

advanced ICT systems, but also competent in the design, implementation and maintenance of such systems, and studies in the field of Electronics and Telecommunications prepare students for this role, among others. The local specificity of Małopolska is - in addition to the well-known high demand of enterprises from the telecommunications and ICT industries, also a visible increase in demand for engineers with high competences in the field of circuits and systems - which is the result of the opening and expansion of branches of international companies, e.g. Aptiv Centrum Techniczne (formerly Delphi), Energy Micro, Silicon Creation) and many dynamically developing and conquering new markets domestic entities (Fideltronik, Elsta Electronics, Aldec, Semi Half). High opinions about the direction have been repeatedly expressed by representatives of enterprises - members of the Social Council operating at WIET, which is an important exponent of the needs of the labor market, a source of proposals, an opinion maker and a consultant for directional changes and current corrections. Some improvements in the educational program are introduced at the request of students, taking into account the opinion of the Faculty Student Government Council (WRSS). Students participate in the process of creating study plans and programs for individual subjects.

Education paths - scope in Polish and in English

Graduation paths - scope in Polish and in English

The names of the majors in Polish and in English

Name [pl]

Name [en]

General information about the curriculum

Field of study: Electronics and Telecommunications

General information related to the curriculum (general learning objectives and employment opportunities, typical jobs and opportunities for graduate continuing education)

A graduate of Electronics and Telecommunications studies has knowledge in the field of:

- digital signal processing and analysis, operating systems, virtualization, programming (Assembler, VHDL, C, C++, Java, Python), creating web and network applications (also for mobile devices),
- simulation and design of analog and digital electronic systems, radio and fiber optic devices, microprocessor programming and embedded systems, measurement and validation of devices in a real work environment,
- signal transmission techniques, Internet networks, cellular networks, Wi-Fi networks, operator networks, principles of network organization and administration, communication protocols, traffic engineering, creation of virtual networks and cloud computing, network devices (routers, switches, firewalls) and data security.

A graduate of these studies is able to:

- design electronic systems based on specialized analog ones and digital integrated circuits, processors and programmable circuits,
- design network systems intended for various transmission channels and types of transmitted data,
- use measurement tools (arbitrary generators, oscilloscopes, protocol testers, spectrum analyzers, measurement cards) and software in the process of building electronic and network devices,
- configure devices (routers, switches, firewalls, virtual networks) and communication protocols in local and wide-area IT networks,
- conduct computer simulations of electronic systems and services in networks,
- administer computer networks and diagnose problems with their operation,
- implement algorithms and build your own programs for mobile devices, embedded systems, create websites and network applications,
- conduct projects using planned and agile methods.

The studies enable you to undertake second-cycle studies in the field of Electronics and Telecommunications on one of two diploma paths: Embedded Systems or Networks and Services. Graduates of this field successfully continue their education in related fields such as Teleinformatics or Computer Science.

Information on including the conclusions from the students and graduates careers monitoring in the curriculum

These studies are well rated by graduates. This is proven by research of the Career Center and external centers. For example, according to research by the AGH Career Center, almost 80% of respondents, graduates of Electronics and Telecommunications at AGH, are satisfied with their professional position and the knowledge and skills acquired during their studies. In turn, in the ranking of engineering studies conducted this year (2018) by the weekly "Perspektywy" run by WIET, the field of "Electronics and Telecommunications" took first place in Poland.

Reports on the fate of graduates are systematically prepared by the Professional Staff Monitoring Center established within the AGH Career Center, AGH CK. The reports include basic indicators: professional status, work-employment compatibility, time of starting work, as well as more detailed indicators, among others: job search time, legal status of employment, number of job offers, factors determining whether to take up a job, evaluation of studies in the context of preparation for work, graduates' earnings. CK AGH also monitors educational and professional graduates of full-time first-cycle studies. Based on the results of the surveys, it was found that the education process still insufficiently covers competencies related to the ability to use knowledge and apply acquired skills. Showing the application of knowledge (through situational scenarios, case studies and examples of use) is considered an underestimated element of education, which has a negative impact on the level of knowledge consolidation and, as a result, on the skills presented by graduates in the workplace. Appropriate training to prepare research and teaching staff to change this state of affairs is provided for in the application for the AGH ZPR. This is a project whose implementation covers the years 2018–2022 (competition POWR.03.05.00-IP.08-00-

PZ3/17, project value: PLN 39,187,505.98, eligible expenses, i.e. direct costs for WIET: PLN 1,592. PLN 759.00).

The second observation in the results of the analysis of the fate of graduates in the field of Electronics and Telecommunications is the deficit of soft skills among students, which is a characteristic and quite common feature in IT-related fields. Steps have been taken to introduce team engineering theses and additional courses for students as part of the above-mentioned POWER projects.

Information on including the requirements and recommendations of the accreditation committees, in particular the Polish Accreditation Committee and industry accreditation committees in the curriculum

1. Defects in the curriculum of part-time studies (too large share of lectures compared to "active" classes)

Based on the recommendations of the Polish Accreditation Committee and modifications to the education programs resulting from the adopted National Qualifications Framework, changes were introduced to the education programs in the EiT field. It resulted in new education programs effective from the 2013/2014 academic year. The share of "Active classes" (exercises, laboratories, projects, seminars) in full-time first- and second-cycle studies exceeds 50% of the total number of classes, in the case of second-cycle studies, these deviations range between 2% and 5% depending on the specialization in part-time second-cycle studies. . Work is currently underway to modify the education program for full-time first-cycle EiT studies (as part of the POWER program), and in the coming years it will also include part-time studies.

2. Comments on the diploma process:

2.1. numerous diploma theses conducted by assistant professors (diploma theses are not entrusted through the Faculty Council).

2.2. in some works, the research task is not formulated, and there are purely review works

2.3. a two-person work with no indication of the contribution of individual authors

Ad.2.1. Due to the large number of students, including diploma students, diploma theses must also be conducted by experienced doctors. Pursuant to section 5 pairs 25 of the Study Regulations "The student works on the diploma thesis under the supervision of an authorized academic teacher (thesis supervisor): a professor or a doctor habilitated for theses.

master's diplomas and professor, habilitated doctor and doctorate for theses engineering and bachelor's degrees. Dean of the Faculty after consulting the Council

The Faculty may authorize a doctor to supervise a master's thesis, a

specialist in a given field - to supervise engineering and bachelor's thesis

or Master's degree. Doctors are entrusted with conducting diploma theses in accordance with the resolution of the Faculty Council 646/2018, paragraph 6, under which: "The Dean of the Faculty authorizes doctors or specialists holding a doctoral degree to supervise master's theses."

Ad.2.2. and 2.3 Diploma rules have been introduced and diploma procedures have been developed in each of the Diploma Departments: Resolution 369/2016 with Annexes 1 and 2.

Information on including examples of good practice in the curriculum

In order to achieve better and better educational outcomes, the teaching staff uses teaching methods consistent with current trends in academic teaching. In addition to the traditional explanatory method, some lectures use problem-based and demonstration-based methods, as well as discussion elements. During laboratory classes, various activation methods are often used, such as discussion, quizzes or group work. The participation of most employees in didactic training conducted as part of the POWER-WIET program, which is used to improve didactic competences, allows for a broader and more systematic implementation of innovative didactic methods. These trainings include, among others, problem-based methods (including WebQuest, Design Thinking), methods of teaching by doing (including case study, the inverted university method, the 3P method), activation methods (including gamification, Escape Room, methods using interactive systems), methods increasing teaching effectiveness (including coaching, mentoring, tutoring, the 4C approach). The specificity of teaching forms means that lectures (regardless of the forms of student activation used) primarily serve to achieve the learning outcomes related to knowledge, while auditorium exercises, laboratories and project work - mainly to skills, but also to social competences. Below are examples of teaching methods and good practices implemented in the teaching process:

*Knowledge + Skills = Lecture + Laboratory + Project. The basis for the implementation of many subjects is the combination of laboratory classes with project work.

*Design Laboratory. Introduction of the subject in the 5th semester of studies, which introduces research topics related to the field of study and leads to the implementation of a simple project in accordance with the assumed methodology. A characteristic feature of this subject is also the preparation of documentation in English, allowing the acquisition of the ability to create reports, reviews of the state of knowledge in a given topic and scientific publications.

*Implementation of teamwork, both within teams formed during laboratory exercises and project work, serves to improve the competence of cooperation in a group.

*Participation of companies from the socio-economic environment in conducting classes. Scientific research and cooperation with the socio-economic environment of the Faculty's employees make it possible to introduce elective subjects to the educational offer, correlated with current trends in the development of electronic and telecommunications systems. The effect of such cooperation is the introduction of subjects to the study program, which are initially prepared and conducted jointly by academic teachers and employees of companies with which the Faculty cooperates. In subsequent years, thanks to the transfer of knowledge, the competences of the Faculty's employees increase, which allows for the complete takeover of conducting such subjects (e.g.: Assembly of Electronic Systems, Advanced Enterprise Networks)

*Scientific and research competences are also shaped in students of first and second cycle studies as part of the subject "Scientific Club".

To sum up, in the curriculum of the Electronics major, it is possible to indicate Good Practices that can be disseminated and implemented in other academic centers due to the observed effects of the educational process:

- basing the curriculum on the competences of the staff running the major, related to the scientific research generated in the unit and the expectations of the labor market,
- organizing elective subjects in cooperation with companies from the socio-economic environment, and taking over their management as the staff compensation increases,
- realization of diploma theses in cooperation with external companies, as well as works constituting the basis for registering intangible assets at AGH and applying for patent protection;
- possibility of passing one of the elective subjects based on work in the Scientific Club.
- use of innovative teaching methods; a method proven in several subjects is the so-called a flipped classroom, requiring knowledge and understanding of the material that will be discussed in class,
- combining laboratory classes with project work, enabling consolidation of knowledge and skills,
- implementation of project work in teams, in order to acquire social competences expected on the labor market.
- defining a fixed workload in organizing elective subjects, allowing students to freely choose them,
- implementation of the Diploma system to support the process of completing diploma theses,
- hybrid teaching – combining classic forms of classes with e-learning elements.

Information on cooperation in the preparation of the curriculum with external stakeholders, in particular associations, professional and social organizations

In order to properly develop the concept of education at the faculty offering the E&T major, the Social Council (SC) was established. The Council is a collegial advisory body working to develop cooperation between WIET and external economic entities and organizations. The main issues of its operation are adapting the scope of knowledge, skills and social competences of WIET graduates to the needs and requirements of employers and developing cooperation between the University in the field of research and development with entities from its environment. The Council is one of the forms of implementation of the WIET development strategy in the field of expanding cooperation with external stakeholders. The Social Council is open in nature. It consists of representatives of enterprises, institutions, state and local government offices, as well as individual natural persons whose activities are related to the directions of education of students and scientific research carried out at WIET. The tasks of the Social Council are specified in the Regulations of the RS. These include:

- exchange of information on employers' expectations towards AGH graduates and related assistance in monitoring the professional development of the Faculty's graduates,
- formulation of proposals to adapt the Faculty's educational and research offer to the current expectations of companies and

institutions,

- promoting the participation of employees of external entities in the student education process by, among others, organizing didactic classes with their participation, as well as assistance in organizing student internships and placements,
- actions to promote the Faculty and the fields of study conducted by the Faculty,
- supporting the exchange of information between the communities represented in the Social Council and creating conditions conducive to undertaking joint ventures in the areas of education, research and development activities and initiating such ventures.

Duration, rules and form of the practical placement

The internship lasts 4 weeks during the summer break after the 6th semester of full-time first-cycle studies. It is possible to do the internship outside the designated period, provided that it does not conflict with other classes. The scope of the internship includes, among others, learning the methodologies of designing electronic devices, building software, servicing industrial devices and data transmission, as well as learning the procedures of work organization. The Faculty of IEiT selects places where students can do their internships. Students have a wide range of possibilities in this respect. The scope and time of the internship are verified by the Student Internship Supervisor. Students can also do an internship at the Department of Electronics in one of the scientific teams. The student receives full information on the implementation and settlement of the specialized internship directly by e-mail through the Virtual Dean's Office at the beginning of the semester, for which completion of the specialized internship is required. The most important companies that the Faculty cooperates with include: Microsoft, Motorola Solutions, Fideltronik, COMARCH, Ericson, Capgemini, Alleiron, IBM, ELSTA ELEKTRONIKA, CISCO, Energy Micro AS, QUMAK, Orange, Akamai, Nokia, Semihalf, Parasoft, EC System, AV System, Metronic AK. Details of the implementation of the internship are regulated by the syllabus of the subject Directional internship IEL-1-604-s (https://syllabuskrk.agh.edu.pl/2019-2020/pl/magnesite/study_plans/stacjonarne-elektronika/module/iel-1-604-s-zimowy-praktyka-kierunkowa) and the Procedure for handling the matter at the IET Faculty: PD - PS - 16 - <http://www.iet.agh.edu.pl/pl/studenci/procedury/praktyka/>

Admission criteria, rules and policies

Field of study: Electronics and Telecommunications

Description of competences expected from the candidate applying for admission to studies

A candidate for first-cycle studies in the field of Electronics and Telecommunications should have competences in the field of mathematics and physics typical for a high school graduate, after completing a mathematics-physical class.

The prerequisite for admission to first-cycle studies is having a matriculation certificate.

More information:

<https://kandydaci.agh.edu.pl/rekrutacja/warunki-i-tryb-rekrutacji-na-studia-w-agh/warunki-i-tryb-rekrutacji-na-studia-i-stopnia-w-roku-academic-2019-2020/>

Recruitment conditions, including the winners and finalists of the central level high school scientific Olympics, as well as winners of international and national contests

The principles and conditions of recruitment are specified in the Resolution of the AGH Senate on the conditions, procedure and start and end dates of recruitment for the first year of first-cycle and second-cycle studies in a given academic year.

The expected limit of admissions to studies along with an indication of the minimum number of admitted candidates required to successfully launch a study cycle

Minimum number of students: 24

Maximum number of students: 30

Learning outcomes

Field of study : Electronics and Telecommunications

Knowledge

KEU symbol	Learning outcomes prescribed to a field of study	CEU symbol
ETE1A_W01	has knowledge of mathematics, including algebra, analysis, probabilistykę and elements of discrete mathematics and numerical methods, necessary to: description and analysis of the operation of electrical circuits, electronic circuits, signal processing, and analysis and modeling of telecommunications networks. Has an ordered knowledge of mathematical analysis, in particular: -Calculus and calculus of functions of one variable and its uses -calculus and calculus of functions of many variables and its uses -equations ordinary differential Has structured knowledge of: - the elements of algebra and linear algebra -logic elements -analytic geometry in R2 and R3 -elements of discrete mathematics Has structured knowledge of probability, in particular: - probability -statistics	P6S_WG_A
ETE1A_W02	has knowledge in the field of physics, including mechanics, thermodynamics, optics, electricity and magnetism, nuclear physics, photonics and physics of solids, including the knowledge necessary to understand the basic physical phenomena occurring devices electronic and transmission systems. Has knowledge of the principles of conduct and develop a physical measuring uncertainty of measurement results and their determination.	P6S_WG_A
ETE1A_W03	has an ordered knowledge of theory of electrical circuits, signal theory (methods of the processing)	P6S_WG_A
ETE1A_W04	Has knowledge of the electromagnetic waves and their propagation, antenna techniques, wired and wireless transmission of information;	P6S_WG_A
ETE1A_W05	has an ordered knowledge about the materials used in the electronics industry; rules of operation of the electronic components (including optoelectronic elements, the elements and sensors), analogue and digital electronic circuits and simple electronic systems;	P6S_WG_A
ETE1A_W06	has knowledge of architecture and digital systems software and microprocessor, knows the method of their programming in high and low level; know the hardware description languages;	P6S_WG_A
ETE1A_W07	has basic knowledge in metrology, knows and understands the methods of measurement and the extraction of basic size characterizing elements and various types of electronic systems, knows the calculation methods and software tools necessary to analyze the results the experiment;	P6S_WG_A
ETE1A_W08	knows and understands the design methodology of analog and digital electronic circuits (combined version), and electronic systems, knows the computer design and simulation tools and systems;	P6S_WG_A
ETE1A_W09	has an ordered device expertise within the networks, including wireless networks and optical, and startup, configuration, and maintenance of these devices	P6S_WG_A
ETE1A_W10	Is familiar with the basic concepts of data transfer, can specify the characteristics of analog and digital transmission, transmission channel properties, the role of coding, modulation and cryptography, knows the encoding methods of the sounds, images and text in the media	P6S_WG_A
ETE1A_W11	has an ordered knowledge on networks of varying scope (local, wide area and aggregate), principles of their organization and administration, used in their communication protocols, addressing policy, mechanisms for the selection of routes, mechanisms traffic engineering, virtual networking mechanisms;	P6S_WG_A
ETE1A_W12	knows and understands a layered model of telecommunications network equipment, as well as the specific features of each layer for the selected network devices;	P6S_WG_A

KEU symbol	Learning outcomes prescribed to a field of study	CEU symbol
ETE1A_W13	on and understand processes, construct and manufacture: integrated circuits and micro-systems, simple electronic devices and the design of computer networks and telecommunications	P6S_WG_A_Inz, P6S_WG_A
ETE1A_W14	has an ordered expertise in methodology and programming techniques; knows the rules for selecting a programming language to solve problems in terms of hardware and software services; understand methods of specifying the basic software requirements	P6S_WG_A
ETE1A_W15	has an ordered knowledge of computer architectures, systems, and computer networks, databases, and operating systems, necessary for the installation, operation and maintenance of it tools for information processing	P6S_WG_A
ETE1A_W16	has an elementary knowledge of the life cycle of equipment and electronic systems and ICT; versed in the current state, and the latest trends and development of electronics and telecommunications;	P6S_WG_A_Inz, P6S_WG_A
ETE1A_W17	has the basic knowledge necessary to understand the <i>pozatechnicznych</i> circumstances of engineering activity; familiar with the basic principles of health and safety at work applicable to the electronics industry and telecommunications; has an elementary knowledge of the protection of intellectual property and patent law;	P6S_WK_A
ETE1A_W18	has an elementary knowledge of management, including quality management, and business, as well as the General principles for the creation and development of individual forms of entrepreneurship	P6S_WK_A, P6S_WK_A_Inz

Skills

KEU symbol	Learning outcomes prescribed to a field of study	CEU symbol
ETE1A_U01	Know how to use the rules of the strict, logical thinking in the analysis of the physical and technical processes Can use known mathematical engine to the description and analysis of the basic physical and technical issues, in particular: -know how to use calculus to compute the approximate-knows how to apply calculus and calculus to physics and technical sciences -knows how to use a matrix account -knows how to use the vector account -knows how to solve basic types of equations the differential describing physical phenomena -use description of analytical curves and surfaces in R3 -is able to apply knowledge of probability to analyze experimental data, in particular:-knows how to set the parameters of the random variables and understand their meaning, knows the common distributions of random variables -know how to use the basic methods of statistical inference. Can use the known principles and methods of physics and related mathematical tools to solve common tasks of mechanics, thermodynamics, statistical physics, electricity, magnetism, optics. Can perform a basic physical measurements and develop and present their results, in particular:-can build a simple measurement system using standard measuring devices, in accordance with the given schema and specification,-can appoint results and measurement uncertainty of direct and indirect, can assess the reliability of the measurement results and their interpretation in the context of the knowledge.	P6S_UW_A
ETE1A_U02	It can retrieve information from the literature, databases, and other sources; can integrate information, their interpretation, and also draw conclusions and formulate and justify reviews; has the ability of self-education, m.in. to improve the professional competence;	P6S_UU_A
ETE1A_U03	able to work individually and in a team; know how to estimate the time required for the implementation of commissioned tasks; able to develop and implement work schedule to ensure compliance with the terms;	P6S_UO_A
ETE1A_U04	can develop documentation on the implementation of the engineering tasks and prepare the text that contains an overview of the results of the implementation of this task; able to prepare and present a short presentation on the results of the implementation of the tasks of engineering;	P6S_UK_A

KEU symbol	Learning outcomes prescribed to a field of study	CEU symbol
ETE1A_U05	speaks foreign language sufficiently to communicate, as well as reading comprehension of catalogue cards, application notes, manuals of electronic devices, telecommunications, networking and tools it and similar documents;	P6S_UK_A
ETE1A_U06	able to use known methods and mathematical models and computer simulations to analyze and evaluate the performance of analog and digital electronic circuits, as well as computer networks and telecommunications	P6S_UW_A_Inz_01, P6S_UW_A
ETE1A_U07	can analyze the signals and signal processing systems in the field of time and frequency, using analogue and digital techniques and the appropriate hardware and software tools	P6S_UW_A
ETE1A_U08	can compare the design of electronic circuits and electronic systems due to the commercial and economic criteria (power, speed, cost, reliability, topology, bandwidth, etc.);	P6S_UW_A_Inz_01, P6S_UW_A
ETE1A_U09	able to plan and execute the simulation and measurements of electronic systems, network protocols, databases and simple electronic systems and telecommunications networks, and presents the results in numerical form, and graphics, can make their interpretation and draw appropriate conclusions;	P6S_UW_A_Inz_01, P6S_UW_A
ETE1A_U10	can use the well-chosen methods and devices for measuring basic sizes with elements and electronics, as well as optical networks, cable and wireless; can assess their suitability to solve simple engineering tasks,	P6S_UW_A_Inz_01, P6S_UW_A
ETE1A_U11	can design a process of testing simple electronic systems and telecommunications and, in the case of detection of errors - to perform their diagnosis;	P6S_UW_A_Inz_01, P6S_UW_A
ETE1A_U12	able to formulate a specification of simple electronic and telecommunications systems at the level of the implemented functions; can plan the process of their construction and estimate the cost of their manufacture; can build, run, and test so defined or system;	P6S_UW_A_Inz_02, P6S_UW_A
ETE1A_U13	able to design simple circuits and electronic systems, as well as data transmission systems: cable, optical and wireless, taking into account the specified performance criteria and economical, using appropriate methods, tools and techniques, using the catalogue cards and application notes in order to determine the appropriate components, can design printed circuits, analog and digital (also in the combined version) using specialized software;	P6S_UW_A_Inz_02, P6S_UW_A
ETE1A_U14	can configure devices and communication protocols in the local (wired and radio) and (in particular optical) communication networks; can administer networks and data communication systems and solve emerging problems in them;	P6S_UW_A
ETE1A_U15	can formulate the algorithm uses both a high and low-level programming languages and relevant it tools to develop computer programs, electronic system control programs or device network;	P6S_UW_A_Inz_01, P6S_UW_A
ETE1A_U16	can-by formulating and solving tasks that involve design elements, systems and electronic systems and telecommunications - detect their non-technical aspects, including: environmental, economic and legal, health and safety of work;	P6S_UW_A_Inz_01, P6S_UW_A

Social competence

KEU symbol	Learning outcomes prescribed to a field of study	CEU symbol
ETE1A_K01	understand the need for and possibility of continuous training (second degree and third degree, postgraduate courses)-raising professional competence, personal and social;	P6S_KK_A
ETE1A_K02	understand the validity of and understand non-technical aspects and effects of the engineer's activities, including its impact on the environment, and the responsibility for the decisions;	P6S_KO_A

KEU symbol	Learning outcomes prescribed to a field of study	CEU symbol
ETE1A_K03	understand the validity of behavior in a professional manner, compliance with the rules of professional ethics and respect for the diversity of views and cultures;	P6S_KO_A
ETE1A_K04	is aware of the responsibility for the work and willingness to comply with the principles of team work and responsibility for jointly carried out the task; He can think and act in a way that is entrepreneurial;	P6S_KO_A
ETE1A_K05	is aware of the social role of the graduate of the Technical University, and, in particular, understand the need for the formulation and the transmission to the public - m.in. through the mass media - information and reviews about the achievements of the electronics, telecommunications, and other aspects of the activities of the engineer; shall endeavour to provide such information and opinions in a commonly understandable;	P6S_KR_A

Compliance table of engineering competence (Inz) with directional learning outcomes (KEU)

Major : Electronics and Telecommunications

Knowledge

CEU symbol	Learning outcomes for qualifications including engineering competence	KEU references
P6S_WG_A_Inz	knowledge of basic processes taking place in the life cycle of technical devices, facilities and systems	ETE1A_W13, ETE1A_W16
P6S_WK_A_Inz	knowledge of basic principles of creating and developing various forms of individual entrepreneurship	ETE1A_W18

Skills

CEU symbol	Learning outcomes for qualifications including engineering competence	KEU references
P6S_UW_A_Inz_01	ability to plan and carry out experiments, including measurements and computer simulations as well as to interpret the obtained results and draw conclusions out of them. When identifying and formulating the specification of engineering problems and solving them, being able to: - use analytical, simulation and experimental methods; - recognize their systemic and non-technical aspects, including ethical connotations; - conduct a preliminary economic assessment of the proposed solutions and planned engineering activities; - perform a critical analysis of the functioning of existing technical solutions to further evaluate them;	ETE1A_U06, ETE1A_U08, ETE1A_U09, ETE1A_U10, ETE1A_U11, ETE1A_U15, ETE1A_U16
P6S_UW_A_Inz_02	ability to design solutions in compliance with the given specification as well as being able to: create simple devices, facilities and systems typical for the study major or implement processes using skillfully chosen methods, techniques, tools and materials	ETE1A_U12, ETE1A_U13

Course	Code	Semestr	ETEIA_W01	ETEIA_W02	ETEIA_W03	ETEIA_W04	ETEIA_W05	ETEIA_W06	ETEIA_W07	ETEIA_W08	ETEIA_W09	ETEIA_W10	ETEIA_W11	ETEIA_W12	ETEIA_W13	ETEIA_W14	ETEIA_W15	ETEIA_W16	ETEIA_W17	ETEIA_W18	ETEIA_U01	ETEIA_U02	ETEIA_U03	ETEIA_U04	ETEIA_U05	ETEIA_U06	ETEIA_U07	ETEIA_U08	ETEIA_U09	ETEIA_U10	ETEIA_U11	ETEIA_U12	ETEIA_U13	ETEIA_U14	ETEIA_U15	ETEIA_U16	ETEIA_K01	ETEIA_K02	ETEIA_K03	ETEIA_K04	ETEIA_K05													
Computer Measurement Systems	IETES.ii100.5451224768aa76cfa740664bdc352514.24	5s	x				x	x	x	x		x				x	x					x	x			x	x	x	x												x													
Design Laboratory	IETES.ii10K.2ca0551ad98ec07b8f18d7c61383c435.24	5s																				x	x	x	x					x	x	x	x	x		x		x	x	x	x	x												
Object-Oriented Programming Language	IETES.ii100.849664df557e5d66e2e5f57c1abfc7e9.24	5s														x		x													x				x		x						x											
Integrated Circuits and Systems	IETES.ii100.f1edb2fe4efd9d93f59edc4ded4bbe4.24	5s	x	x			x																					x																		x								
RF Electronics	IETES.ii100.292ce824cfca2b641a8dd4d8f7b72989.24	5s			x	x																					x																											
Multimedia Information Processing and Communications	IETES.ii200.2b16500ab48a7cc8c5b5492ff81ee7c7.24	6s										x															x																											
Sensor Technology	IETES.ii200.7260b5ceec9c4e56320ad83826cbf80f.24	6s	x	x			x		x	x					x								x	x	x	x		x		x	x	x															x							
Design Digital Systems in Hardware Description Languages	IETES.ii200.570c62f69001c3717bffc4158bda7325.24	6s	x					x		x																																												
Databases	IETES.ii200.76042964bce5f9f1e617f36c5a1b596a.24	6s															x																																					
Introduction to Java Programming	IETES.ii200.78995a5fcc663d26d1ff7eaaf11a007.24	6s						x																																														
Students Research Group	IETES.ii200.96d4f43164be711bda1eaa4ae26fef74.24	6s	x	x		x					x	x	x	x		x	x																																					
Diploma Laboratory 1	IETES.ii20K.63876e67559a2.24	6s														x	x																																					
Securing Data Transmission: Cryptology, Watermarking and Steganography	IETES.ii200.6b17871fc723023408f0db79a64f5dde.24	6s	x										x																																									
Switching nodes for telecommunication and computer networks	IETES.ii200.9fecdf5d1da3d31924100f0d6b7a9db1.24	6s	x	x																																																		
Wireless Techniques and Systems	IETES.ii200.03ae94790910500e2588f31db159e27a.24	6s	x				x					x	x																																									
Professional practice	IETES.ii200.557aa2c67bc9c194cb3ea1eac55ffe27.24	6s																																																				
MPLS Networks	IETES.ii400.510e148d4939ea1db972b95903635136.24	7s																																																				

Course	Code	Semestr	ETEIA_W01	ETEIA_W02	ETEIA_W03	ETEIA_W04	ETEIA_W05	ETEIA_W06	ETEIA_W07	ETEIA_W08	ETEIA_W09	ETEIA_W10	ETEIA_W11	ETEIA_W12	ETEIA_W13	ETEIA_W14	ETEIA_W15	ETEIA_W16	ETEIA_W17	ETEIA_W18	ETEIA_U01	ETEIA_U02	ETEIA_U03	ETEIA_U04	ETEIA_U05	ETEIA_U06	ETEIA_U07	ETEIA_U08	ETEIA_U09	ETEIA_U10	ETEIA_U11	ETEIA_U12	ETEIA_U13	ETEIA_U14	ETEIA_U15	ETEIA_U16	ETEIA_K01	ETEIA_K02	ETEIA_K03	ETEIA_K04	ETEIA_K05							
Speech Processing	IETES.ii400.1352be83264f6f8bd7fdfe69079bcfbf.24	7s	x									x						x									x																					
Programming in Python Language	IETES.ii400.60a75d81b0a84.24	7s													x							x	x												x							x						
Programming for Android	IETES.ii400.152553bc6e2d5d33b5bee04b0679d257.24	7s								x																																						
Advanced Java Programming	IETES.ii400.ece48d217725e472f306178cd83d6a53.24	7s						x														x		x												x	x						x					
Applications of Digital Signal Processors	IETES.ii400.e552fd94436166b283294b7b6d5b99fa.24	7s			x							x										x																						x				
Seminar on ICT	IETES.ii400.7d2c6d79609f2bcbe9542887671089d1.24	7s	x									x										x	x	x	x	x																						
Diploma Seminar	IETES.ii400.113e607328fe3b1feac36d5c37a13bcd.24	7s																				x	x	x																								
Final Project	IETES.ii400.d0b468d65b7dc665a0381d9957a5c950.24	7s																			x	x	x	x	x	x																						
Diploma Laboratory 2	IETES.ii40K.6387721d77c1b.24	7s																			x	x																										
Sum (obligatory):			17	9	4	2	8	1	7	5	1	5	6	2	3	9	3	7	4	1	3	19	11	11	6	11	7	9	7	8	4	9	7	4	4	5	21	11	10	16	12							
Sum (elective):			7	3	1	1	1	3	1	4	2	6	2	1	1	2	2	2	4	2	0	13	5	9	4	2	4	0	3	2	2	4	1	2	6	4	13	4	4	10	4							
Sum:			24	12	5	3	9	4	8	9	3	11	8	3	4	11	5	9	8	3	3	32	16	20	10	13	11	9	10	10	6	13	8	6	10	9	34	15	14	26	16							

Characteristics matrix of learning outcomes in relation to modules

Major: Electronics and Telecommunications

2024/2025/S/li/IEiT/ETE/all

Course	Code	Semestr	P65_WG_A	P65_WG_A_Inz	P65_WK_A	P65_WK_A_Inz	P65_UW_A	P65_UU_A	P65_UO_A	P65_UK_A	P65_UW_A_Inz_01	P65_UW_A_Inz_02	P65_KK_A	P65_KO_A	P65_KR_A
Algebra	IETES.li10.5c7fd2ae7c5cff56692ac76a3173da65.24	1s	x												x
Information Technology	IETES.li10.09ded102d61b53897f95b6fff27850c9.24	1s	x		x	x	x	x	x	x	x			x	x
Mathematical Analysis 1	IETES.li10.4ec9252d59607bcc5bc5b8422e1b5182.24	1s	x												x
Methodology and Programming Techniques 1	IETES.li10.0c7703279c131a275e7636e25d353e0e.24	1s	x			x				x		x			
Circuits Theory 1	IETES.li10.2d2051f7f0fb9cb11481d10c141a7b99.24	1s	x			x				x		x	x		
Physics 1	IETES.li10.6a57bdba13a275784da9318b77db98f1.24	1s	x			x	x							x	
Russian B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 1/3	IETES.li20.9207a194b6d4f62b09f23e6556e6b2ed.24	2s													
English B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 1/3	IETES.li20.df2639cc44c5e396cf0074ea122cab71.24	2s													
Circuits Theory 2	IETES.li20.a1dd92588dca394f0d223b537b517138.24	2s	x			x	x	x	x	x			x	x	
German B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 1/3	IETES.li20.375d0ed08478ee775e900113312791c3.24	2s													
Spanish B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 1/3	IETES.li20.e2e9f855d3be1c6e44f1609c9b3733bf.24	2s													

Course	Code	Semestr	P6S_WG_A	P6S_WG_A_Inz	P6S_WK_A	P6S_WK_A_Inz	P6S_UW_A	P6S_UU_A	P6S_UO_A	P6S_UK_A	P6S_UW_A_Inz_01	P6S_UW_A_Inz_02	P6S_KK_A	P6S_KO_A	P6S_KR_A
French B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 1/3	IETES.li20.e553773bdd5bdb73e59798df5bf39847.24	2s													
Mathematical Analysis 2	IETES.li20.3d4adc4c0e85ba0afc9317c1bd5592a1.24	2s	x										x		x
Electronic Metrology	IETES.li20.ea91fef80b3ffb147971b1cfef76f275.24	2s	x										x	x	
Electronic Devices	IETES.li20.003ee3e95bf397334b9ece408f32ff9e.24	2s	x			x	x			x			x	x	
Methodology and Programming Techniques 2	IETES.li20.42df48946d74db35e157bab06613764a.24	2s	x			x				x			x		
Probability Theory and Statistics	IETES.li20.60a65b045e1b2.24	2s	x			x	x	x		x			x	x	
Physics 2	IETES.li20.e4f6c7a276d8f7720505264b04b5bc2a.24	2s	x			x				x	x		x	x	
German B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 2/3	IETES.li40.194f7fd6b2f8791bf3f31dfd0a5d917d.24	3s													
Fundamentals of management	IETES.li40.6a658fd635153e248d94e96829470083.24	3s			x	x	x	x			x				
Fundamentals of Economics, Finance and Business Law	IETES.li40.0f8968b48c68a4af7e61ec00be2a39fb.24	3s			x	x									
French B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 2/3	IETES.li40.022ccfa514f05e50192ce87a0bff56b7.24	3s													
Russian B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 2/3	IETES.li40.1b348d99edf04f5b24411f8925d672c5.24	3s													
English B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 2/3	IETES.li40.53db5d5bb3888bb0d3df2be2aca157b1.24	3s													
Computational Techniques	IETES.li40.e14d4ec0cb6a788f0d5be71f895692d3.24	3s	x				x	x	x	x	x		x	x	
Spanish B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 2/3	IETES.li40.a7a0e38e103236aa9b214adde0985c59.24	3s													

Course	Code	Semestr													
			P6S_WG_A	P6S_WG_A_Inz	P6S_WK_A	P6S_WK_A_Inz	P6S_UW_A	P6S_UU_A	P6S_UO_A	P6S_UK_A	P6S_UW_A_Inz_01	P6S_UW_A_Inz_02	P6S_KK_A	P6S_KO_A	P6S_KR_A
Digital Electronics and Programmable Devices	IETES.li40.9db28b6bc79b035b51c97744d7de83e9.24	3s	x				x			x	x	x		x	
Signals and Systems	IETES.li40.f134db78cbd615f03e02af7de7c11227.24	3s	x				x	x			x		x		
Simulation Techniques	IETES.li40.6536193933478.24	3s	x	x			x	x		x	x		x	x	x
Analogue Electronic Circuits 1	IETES.li40.ccc7b0a639d768d6d4f5377af3a67524.24	3s	x	x			x				x	x	x	x	
Introduction to Telecommunications	IETES.li40.05f78b6d871fe8ea9080fdf842ac01c3.24	3s	x				x				x				
German B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 3/3	IETES.li80.e9248a9a134c74395721cf546e69ecdf.24	4s													
Patent Law	IETES.li80.52766dd35dace89fcd11124686d4334c.24	4s			x		x				x			x	
Protection of intellectual property	IETES.li80.0e0dcbeffcd00d69645f69cd6d1f00e.24	4s			x			x					x	x	
English B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 3/3	IETES.li80.5e50e9a2d67b5162c856cf859a9b227f.24	4s													
French B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 3/3	IETES.li80.6807c4d8cf5331d62a78d10b502b9ccb.24	4s													
Russian B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 3/3	IETES.li80.49d62cc9cd39f7fb09b10f8cfbeb7b06.24	4s													
Digital Signal Processing	IETES.li80.37b6536d9971294e0ceeb6ae2707781c.24	4s	x				x	x					x		x
Spanish B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 3/3	IETES.li80.001aefb3b9af1096e2664b81b183c217.24	4s													
Optoelectronics	IETES.li80.9ca91b4f4305e4cb16ed5fd7bdc80fa3.24	4s	x							x					x
Analogue Electronic Circuits 2	IETES.li80.3e6344df3813316d9a76cb18f05ba26e.24	4s	x	x			x				x	x	x	x	

Course	Code	Semestr													
			P6S_WG_A	P6S_WG_A_Inz	P6S_WK_A	P6S_WK_A_Inz	P6S_UW_A	P6S_UU_A	P6S_UO_A	P6S_UK_A	P6S_UW_A_Inz_01	P6S_UW_A_Inz_02	P6S_KK_A	P6S_KO_A	P6S_KR_A
Microprocessor Technology 1	IETES.li80.43cb65be4b04f29516b44ec575b208d1.24	4s	x				x	x		x	x	x	x	x	
Computer Networks	IETES.li80.ddf71bd4a5b4ae28ab58253386e78e12.24	4s	x	x	x		x	x				x		x	x
Operating Systems	IETES.li80.76cff58f85a90981008842c821b82002.24	4s	x				x					x			x
Introduction to Mechanics	IETES.li100.0627946e14b1cfd841f615ac2ab00e48.24	5s	x					x		x				x	
Microprocessor Technology 2	IETES.li100.900d4e61198eb78f386a0033e765b392.24	5s	x				x					x			
CAD and 3D modeling	IETES.li100.d6a80b17d9113cfe37bc31f6380243a1.24	5s	x									x			x
Telecommunication Networks and Systems	IETES.li100.8bbf4c2803191fd4d61b195927d89c00.24	5s	x	x	x		x	x		x	x		x	x	
Computer Measurement Systems	IETES.li100.5451224768aa76cfa740664bdc352514.24	5s	x				x	x	x		x		x		
Design Laboratory	IETES.li10K.2ca0551ad98ec07b8f18d7c61383c435.24	5s					x	x	x	x	x	x		x	x
Object-Oriented Programming Language	IETES.li100.849664df557e5d66e2e5f57c1abfc7e9.24	5s	x	x			x					x	x	x	x
Integrated Circuits and Systems	IETES.li100.f1edb2fe4efdf9d93f59edc4ded4bbe4.24	5s	x				x					x			x
RF Electronics	IETES.li100.292ce824cfca2b641a8dd4d8f7b72989.24	5s	x				x					x	x		
Multimedia Information Processing and Communications	IETES.li200.2b16500ab48a7cc8c5b5492ff81ee7c7.24	6s	x				x					x		x	
Sensor Technology	IETES.li200.7260b5ceec9c4e56320ad83826cbf80f.24	6s	x	x			x	x	x	x	x	x	x	x	x
Design Digital Systems in Hardware Description Languages	IETES.li200.570c62f69001c3717bffc4158bda7325.24	6s	x				x				x	x	x	x	x
Databases	IETES.li200.76042964bce5f9f1e617f36c5a1b596a.24	6s	x				x	x			x	x			
Introduction to Java Programming	IETES.li200.78995a5fccc663d26d1ff7eaaf11a007.24	6s	x				x	x		x	x			x	
Students Research Group	IETES.li200.96d4f43164be711bda1eaa4ae26fef74.24	6s	x		x		x	x	x	x	x		x	x	x

Course	Code	Semestr													
			P6S_WG_A	P6S_WG_A_Inz	P6S_WK_A	P6S_WK_A_Inz	P6S_UW_A	P6S_UU_A	P6S_UO_A	P6S_UK_A	P6S_UW_A_Inz_01	P6S_UW_A_Inz_02	P6S_KK_A	P6S_KO_A	P6S_KR_A
Diploma Laboratory 1	IETES.li20K.63876e67559a2.24	6s	x	x			x	x			x	x	x	x	x
Securing Data Transmission: Cryptology, Watermarking and Steganography	IETES.li200.6b17871fc723023408f0db79a64f5dde.24	6s	x				x	x	x	x	x	x	x	x	x
Switching nodes for telecommunication and computer networks	IETES.li200.9fecdf5d1da3d31924100f0d6b7a9db1.24	6s	x												x
Wireless Techniques and Systems	IETES.li200.03ae94790910500e2588f31db159e27a.24	6s	x				x				x				x
Professional practice	IETES.li200.557aa2c67bc9c194cb3ea1eac55ffe27.24	6s	x	x	x	x	x	x	x	x	x			x	x
MPLS Networks	IETES.li400.510e148d4939ea1db972b95903635136.24	7s	x				x	x					x	x	
Speech Processing	IETES.li400.1352be83264f6f8bd7fdfe69079bcfbf.24	7s	x	x			x								
Programming in Python Language	IETES.li400.60a75d81b0a84.24	7s	x				x	x	x		x			x	
Programming for Android	IETES.li400.152553bc6e2d5d33b5bee04b0679d257.24	7s	x				x				x		x		
Advanced Java Programming	IETES.li400.ece48d217725e472f306178cd83d6a53.24	7s	x				x	x		x	x		x	x	
Applications of Digital Signal Processors	IETES.li400.e552fd94436166b283294b7b6d5b99fa.24	7s	x				x	x					x		x
Seminar on ICT	IETES.li400.7d2c6d79609f2bcbe9542887671089d1.24	7s	x				x	x	x	x	x		x	x	x
Diploma Seminar	IETES.li400.113e607328fe3b1feac36d5c37a13bcd.24	7s						x	x	x				x	x
Final Project	IETES.li400.d0b468d65b7dc665a0381d9957a5c950.24	7s					x	x	x	x	x	x		x	x
Diploma Laboratory 2	IETES.li40K.6387721d77c1b.24	7s					x	x	x		x			x	x
Sum (obligatory):			34	8	4	1	32	19	11	12	30	9	21	27	12
Sum (elective):			17	2	5	2	16	13	5	9	13	4	13	12	4

Course	Code	Semestr	P6S_WG_A	P6S_WG_A_Inz	P6S_WK_A	P6S_WK_A_Inz	P6S_UW_A	P6S_UU_A	P6S_UO_A	P6S_UK_A	P6S_UW_A_Inz_01	P6S_UW_A_Inz_02	P6S_KK_A	P6S_KO_A	P6S_KR_A
Sum:			51	10	9	3	48	32	16	21	43	13	34	39	16

Matrix of learning outcomes prescribed to a field of study with related forms of classes and the method of testing

Major: Electronics and Telecommunications

2024/2025/S/II/IEiT/EtE/all

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
Algebra	Lectures, Auditorium classes	Test, Examination, Test, Examination, Oral answer	ETE1A_W01, ETE1A_K05
Information Technology	Lectures, Project classes	Test results, Presentation	ETE1A_W17, ETE1A_U16, ETE1A_K03, ETE1A_K05, ETE1A_W10, ETE1A_W11, ETE1A_U03, ETE1A_U02, ETE1A_U04, ETE1A_U05
Mathematical Analysis 1	Lectures, Auditorium classes	Test, Examination, Test, Examination, Oral answer	ETE1A_W01, ETE1A_K05
Methodology and Programming Techniques 1	Lectures, Laboratory classes	Examination, Completion of laboratory classes, Test, Completion of laboratory classes	ETE1A_W14, ETE1A_U15, ETE1A_K01
Circuits Theory 1	Lectures, Auditorium classes	Activity during classes, Test, Activity during classes, Test	ETE1A_W07, ETE1A_W01, ETE1A_U06, ETE1A_U10, ETE1A_K01, ETE1A_K03
Physics 1	Lectures, Auditorium classes	Activity during classes, Execution of exercises, Activity during classes, Execution of exercises	ETE1A_W02, ETE1A_W01, ETE1A_U01, ETE1A_U02, ETE1A_K04
Russian B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 1/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
English B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 1/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
Circuits Theory 2	Lectures, Auditorium classes, Laboratory classes	Activity during classes, Test, Project, Examination, Activity during classes, Test, Project, Examination, Activity during classes, Test, Project, Examination	ETE1A_W07, ETE1A_W01, ETE1A_U06, ETE1A_U07, ETE1A_U10, ETE1A_U02, ETE1A_U03, ETE1A_U04, ETE1A_K01, ETE1A_K03
German B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 1/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
Spanish B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 1/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
French B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 1/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
Mathematical Analysis 2	Lectures, Auditorium classes	Test, Examination, Test, Examination, Oral answer	ETE1A_W01, ETE1A_K01, ETE1A_K05
Electronic Metrology	Lectures, Laboratory classes	Activity during classes, Report, Test results, Activity during classes, Report, Test results	ETE1A_W07, ETE1A_K01, ETE1A_K02
Electronic Devices	Lectures, Laboratory classes	Activity during classes, Test, Examination, Activity during classes, Test, Examination	ETE1A_W01, ETE1A_W02, ETE1A_W05, ETE1A_W14, ETE1A_W11, ETE1A_U02, ETE1A_U07, ETE1A_U08, ETE1A_U09, ETE1A_K01, ETE1A_K02, ETE1A_K03
Methodology and Programming Techniques 2	Lectures, Laboratory classes	Completion of laboratory classes, Execution of laboratory classes, Test	ETE1A_W14, ETE1A_W07, ETE1A_U15, ETE1A_K01
Probability Theory and Statistics	Lectures, Auditorium classes	Test, Examination, Test results, Test, Examination, Test results	ETE1A_W01, ETE1A_W07, ETE1A_U02, ETE1A_U03, ETE1A_U06, ETE1A_K01, ETE1A_K02

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
Physics 2	Lectures, Auditorium classes, Laboratory classes	Activity during classes, Test, Examination, Report, Involvement in teamwork, Oral answer, Activity during classes, Test, Examination, Involvement in teamwork, Oral answer, Activity during classes, Test, Examination, Report, Involvement in teamwork, Oral answer	ETE1A_W02, ETE1A_U01, ETE1A_U04, ETE1A_U09, ETE1A_K01, ETE1A_K04, ETE1A_K02
German B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 2/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
Fundamentals of management	Lectures, Auditorium classes	Test, Execution of exercises	ETE1A_W18, ETE1A_U02, ETE1A_U16
Fundamentals of Economics, Finance and Business Law	Lectures, Auditorium classes	Test, Test	ETE1A_W17, ETE1A_W18
French B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 2/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
Russian B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 2/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
English B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 2/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
Computational Techniques	Lectures, Laboratory classes, Project classes	Activity during classes, Execution of a project, Execution of laboratory classes, Test, Project, Test results, Completion of laboratory classes, Activity during classes, Participation in a discussion, Execution of a project, Execution of laboratory classes, Test, Project, Involvement in teamwork, Test results, Oral answer, Completion of laboratory classes, Activity during classes, Participation in a discussion, Execution of a project, Execution of laboratory classes, Test, Project, Involvement in teamwork, Test results, Oral answer, Completion of laboratory classes	ETE1A_W01, ETE1A_W02, ETE1A_W03, ETE1A_W07, ETE1A_W14, ETE1A_U02, ETE1A_U05, ETE1A_U09, ETE1A_U03, ETE1A_U15, ETE1A_K03, ETE1A_K01, ETE1A_K04

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
Spanish B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 2/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Essay, Test results, Essays written during classes, Presentation	
Digital Electronics and Programmable Devices	Lectures, Auditorium classes, Laboratory classes	Execution of laboratory classes, Test, Examination, Execution of laboratory classes, Test, Examination, Execution of laboratory classes, Test, Examination, Involvement in teamwork	ETE1A_W01, ETE1A_W08, ETE1A_W05, ETE1A_U09, ETE1A_U12, ETE1A_U13, ETE1A_U08, ETE1A_U06, ETE1A_U04, ETE1A_K04
Signals and Systems	Lectures, Auditorium classes	Test, Project, Examination, Test, Project	ETE1A_W01, ETE1A_W14, ETE1A_U02, ETE1A_U06, ETE1A_K01
Simulation Techniques	Lectures, Laboratory classes, Project classes	Test, Test, Report, Test	ETE1A_W01, ETE1A_W03, ETE1A_W05, ETE1A_W08, ETE1A_W16, ETE1A_U02, ETE1A_U07, ETE1A_U08, ETE1A_U04, ETE1A_K01, ETE1A_K02, ETE1A_K04, ETE1A_K05
Analogue Electronic Circuits 1	Lectures, Auditorium classes, Laboratory classes, Project classes	Test, Examination, Test, Examination, Test, Test	ETE1A_W08, ETE1A_W16, ETE1A_W05, ETE1A_W13, ETE1A_U13, ETE1A_U08, ETE1A_U12, ETE1A_K01, ETE1A_K02
Introduction to Telecommunications	Lectures, Laboratory classes	Test, Examination, Test, Examination	ETE1A_W10, ETE1A_U08, ETE1A_U10
German B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 3/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
Patent Law	Lectures	Participation in a discussion, Execution of a project, Involvement in teamwork	ETE1A_W17, ETE1A_U16, ETE1A_K04, ETE1A_K02
Protection of intellectual property	Lectures, Project classes	Test	ETE1A_K04, ETE1A_W17, ETE1A_U02, ETE1A_K01
English B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 3/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
French B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 3/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
Russian B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 3/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
Digital Signal Processing	Lectures, Laboratory classes	Participation in a discussion, Execution of laboratory classes, Test, Examination, Participation in a discussion, Execution of laboratory classes, Test, Examination	ETE1A_W03, ETE1A_W10, ETE1A_U07, ETE1A_U02, ETE1A_K01, ETE1A_K05
Spanish B2 course - compulsory course of 135 hours for students of FIRST-CYCLE studies - semester 3/3	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Test results, Essays written during classes, Presentation	
Optoelectronics	Lectures, Laboratory classes	Examination, Examination, Report	ETE1A_W02, ETE1A_W05, ETE1A_U03, ETE1A_K04
Analogue Electronic Circuits 2	Lectures, Laboratory classes, Project classes	Test, Examination, Test, Examination, Test	ETE1A_W08, ETE1A_W16, ETE1A_W05, ETE1A_W13, ETE1A_U13, ETE1A_U08, ETE1A_U12, ETE1A_K01, ETE1A_K02
Microprocessor Technology 1	Lectures, Laboratory classes, Project classes	Activity during classes, Execution of laboratory classes, Test, Project, Oral answer, Completion of laboratory classes, Activity during classes, Execution of laboratory classes, Test, Project, Oral answer, Completion of laboratory classes, Execution of laboratory classes, Test, Project, Completion of laboratory classes	ETE1A_W15, ETE1A_W01, ETE1A_W02, ETE1A_W14, ETE1A_U08, ETE1A_U04, ETE1A_U12, ETE1A_U02, ETE1A_U05, ETE1A_U13, ETE1A_K02, ETE1A_K01
Computer Networks	Lectures, Laboratory classes	Test, Examination, Case study, Activity during classes, Execution of laboratory classes, Test, Examination, Case study	ETE1A_W11, ETE1A_W12, ETE1A_W16, ETE1A_W17, ETE1A_U14, ETE1A_U11, ETE1A_U02, ETE1A_U16, ETE1A_K01, ETE1A_K04
Operating Systems	Lectures, Laboratory classes, Project classes	Test, Test, Test	ETE1A_W15, ETE1A_W11, ETE1A_U14, ETE1A_U10, ETE1A_K04

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
Introduction to Mechanics	Lectures, Laboratory classes	Activity during classes, Completion of laboratory classes, Activity during classes, Completion of laboratory classes	ETE1A_W08, ETE1A_U02, ETE1A_U04, ETE1A_K01
Microprocessor Technology 2	Lectures, Laboratory classes, Project classes	Participation in a discussion, Test, Examination, Oral answer, Execution of laboratory classes, Test, Project, Examination, Oral answer, Completion of laboratory classes, Execution of laboratory classes, Project, Completion of laboratory classes	ETE1A_W01, ETE1A_W02, ETE1A_U10
CAD and 3D modeling	Lectures, Laboratory classes	Activity during classes, Completion of laboratory classes, Activity during classes, Completion of laboratory classes	ETE1A_W08, ETE1A_U04, ETE1A_K02
Telecommunication Networks and Systems	Lectures, Laboratory classes, Project classes	Examination, Completion of laboratory classes, Examination, Involvement in teamwork, Completion of laboratory classes, Involvement in teamwork	ETE1A_W02, ETE1A_W11, ETE1A_W12, ETE1A_W16, ETE1A_W09, ETE1A_W17, ETE1A_U02, ETE1A_U09, ETE1A_U04, ETE1A_U14, ETE1A_U16, ETE1A_K04, ETE1A_K01
Computer Measurement Systems	Lectures, Laboratory classes	Activity during classes, Execution of laboratory classes, Activity during classes, Execution of laboratory classes	ETE1A_W01, ETE1A_W08, ETE1A_W10, ETE1A_W05, ETE1A_W06, ETE1A_W15, ETE1A_W07, ETE1A_W14, ETE1A_U02, ETE1A_U06, ETE1A_U07, ETE1A_U08, ETE1A_U09, ETE1A_U03, ETE1A_K01
Design Laboratory	Project classes	Activity during classes, Execution of a project, Project, Report, Case study, Presentation	ETE1A_U05, ETE1A_U10, ETE1A_U11, ETE1A_U12, ETE1A_U13, ETE1A_U03, ETE1A_U04, ETE1A_U14, ETE1A_U16, ETE1A_U02, ETE1A_K02, ETE1A_K03, ETE1A_K04, ETE1A_K05
Object-Oriented Programming Language	Lectures, Laboratory classes, Project classes	Involvement in teamwork, Test results, Involvement in teamwork, Test results, Test results	ETE1A_W16, ETE1A_W14, ETE1A_U15, ETE1A_U12, ETE1A_K04, ETE1A_K01
Integrated Circuits and Systems	Lectures, Laboratory classes	Activity during classes, Test, Project, Activity during classes, Test, Project	ETE1A_W01, ETE1A_W05, ETE1A_W02, ETE1A_U08, ETE1A_K04
RF Electronics	Lectures, Laboratory classes	Examination, Completion of laboratory classes, Examination, Completion of laboratory classes	ETE1A_W04, ETE1A_W03, ETE1A_U13, ETE1A_U12, ETE1A_U06

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
Multimedia Information Processing and Communications	Laboratory classes, Project classes	Test, Test	ETE1A_W10, ETE1A_U10, ETE1A_U07, ETE1A_K01
Sensor Technology	Lectures, Laboratory classes	Activity during classes, Execution of laboratory classes, Test, Activity during classes, Execution of laboratory classes, Test, Report	ETE1A_W05, ETE1A_W13, ETE1A_W01, ETE1A_W07, ETE1A_W08, ETE1A_W16, ETE1A_W02, ETE1A_U03, ETE1A_U04, ETE1A_U02, ETE1A_U05, ETE1A_U12, ETE1A_U07, ETE1A_U09, ETE1A_U11, ETE1A_U13, ETE1A_U16, ETE1A_K02, ETE1A_K01, ETE1A_K04
Design Digital Systems in Hardware Description Languages	Lectures, Laboratory classes	Execution of a project, Execution of laboratory classes	ETE1A_W01, ETE1A_W08, ETE1A_W06, ETE1A_U12, ETE1A_U04, ETE1A_U09, ETE1A_U11, ETE1A_K01, ETE1A_K03
Databases	Lectures, Laboratory classes, Project classes	Execution of laboratory classes, Test, Execution of laboratory classes, Project	ETE1A_W15, ETE1A_U02, ETE1A_U09, ETE1A_U10, ETE1A_U12
Introduction to Java Programming	Lectures, Project classes	Activity during classes, Participation in a discussion, Execution of a project, Project, Oral answer, Project, Oral answer	ETE1A_W06, ETE1A_U15, ETE1A_U02, ETE1A_U04, ETE1A_K01
Students Research Group	Project classes	Coordination, conduct of a research project, preparation of a scientific paper, organization, organization of conferences, camps and scientific trips.	ETE1A_W17, ETE1A_W01, ETE1A_W02, ETE1A_W04, ETE1A_W09, ETE1A_W10, ETE1A_W11, ETE1A_W12, ETE1A_W14, ETE1A_W15, ETE1A_U02, ETE1A_U03, ETE1A_U04, ETE1A_U16, ETE1A_U05, ETE1A_K01, ETE1A_K02, ETE1A_K03, ETE1A_K04, ETE1A_K05
Diploma Laboratory 1	Project classes	Activity during classes, Diploma thesis, Presentation	ETE1A_W13, ETE1A_W14, ETE1A_U06, ETE1A_U07, ETE1A_U02, ETE1A_U10, ETE1A_U11, ETE1A_U12, ETE1A_U13, ETE1A_K01, ETE1A_K02, ETE1A_K04, ETE1A_K05

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
Securing Data Transmission: Cryptology, Watermarking and Steganography	Lectures, Project classes, Seminars	Test results, Activity during classes, Participation in a discussion, Execution of a project, Project, Report, Presentation, Report, Scientific paper, Presentation	ETE1A_W01, ETE1A_W10, ETE1A_U02, ETE1A_U03, ETE1A_U04, ETE1A_U05, ETE1A_U06, ETE1A_U12, ETE1A_U14, ETE1A_U15, ETE1A_K01, ETE1A_K03, ETE1A_K04, ETE1A_K05
Switching nodes for telecommunication and computer networks	Lectures, Auditorium classes	Execution of exercises, Activity during classes, Execution of exercises	ETE1A_W01, ETE1A_W02, ETE1A_K04
Wireless Techniques and Systems	Lectures, Laboratory classes	Examination, Examination, Completion of laboratory classes	ETE1A_W04, ETE1A_W11, ETE1A_W10, ETE1A_W01, ETE1A_U09, ETE1A_U06, ETE1A_U07, ETE1A_K04
Professional practice	Practical placement	Report on completion of a practical placement, Confirmation of completion of practical placement programme	ETE1A_W18, ETE1A_W17, ETE1A_W16, ETE1A_U03, ETE1A_U04, ETE1A_U05, ETE1A_U10, ETE1A_U16, ETE1A_U02, ETE1A_K03, ETE1A_K04, ETE1A_K05
MPLS Networks	Laboratory classes, Project classes	Test, Case study, Test, Case study	ETE1A_W11, ETE1A_U14, ETE1A_U02, ETE1A_K01, ETE1A_K04
Speech Processing	Lectures, Laboratory classes	Completion of laboratory classes, Completion of laboratory classes	ETE1A_W01, ETE1A_W10, ETE1A_W16, ETE1A_U07
Programming in Python Language	Lectures, Laboratory classes, Project classes	Project, Project, Project	ETE1A_W14, ETE1A_U03, ETE1A_U15, ETE1A_U02, ETE1A_K04
Programming for Android	Lectures, Project classes	Project, Project	ETE1A_W09, ETE1A_U15, ETE1A_K01
Advanced Java Programming	Lectures, Project classes	Activity during classes, Project, Execution of a project, Project	ETE1A_W06, ETE1A_U15, ETE1A_U02, ETE1A_U04, ETE1A_K04, ETE1A_K01
Applications of Digital Signal Processors	Lectures, Laboratory classes	Participation in a discussion, Execution of laboratory classes, Test, Test results, Completion of laboratory classes, Execution of laboratory classes, Test, Test results, Completion of laboratory classes	ETE1A_W03, ETE1A_W10, ETE1A_U07, ETE1A_U02, ETE1A_K01, ETE1A_K05

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
Seminar on ICT	Lectures, Project classes, Seminars	Test results, Activity during classes, Participation in a discussion, Execution of a project, Project, Report, Presentation, Participation in a discussion, Scientific paper, Presentation	ETE1A_W10, ETE1A_W01, ETE1A_U03, ETE1A_U04, ETE1A_U15, ETE1A_U05, ETE1A_U02, ETE1A_U06, ETE1A_K01, ETE1A_K03, ETE1A_K04, ETE1A_K05
Diploma Seminar	Seminars	Presentation	ETE1A_U02, ETE1A_U03, ETE1A_U04, ETE1A_K03, ETE1A_K05
Final Project	Diploma Thesis	Diploma thesis preparation	ETE1A_U01, ETE1A_U06, ETE1A_U02, ETE1A_U04, ETE1A_U05, ETE1A_U11, ETE1A_U12, ETE1A_U03, ETE1A_K04, ETE1A_K05, ETE1A_K03
Diploma Laboratory 2	Project classes	Engineering project, Presentation	ETE1A_U02, ETE1A_U03, ETE1A_U06, ETE1A_K02, ETE1A_K03, ETE1A_K05

Detailed rules of the implementation of the curriculum established by the Dean of the Faculty (the so-called Study Rules)

Field of study: Electronics and Telecommunications

Enrollment rules for the next semester

The Rules of Study at AGH describe in detail the rules for passing the semester of study (§ 17) and the procedure in the absence of such a pass (§ 18 ÷ 21). In addition, a first-cycle semester (fifth) has been agreed at the first-cycle studies, subject to the entry of complete semesters 1 and 2 (Resolution of the Council of CSET No. 441/2016). According to the Regulations of the AGH University of Science and Technology, obtaining an entry for the semester 7 first-cycle studies requires passing all subjects with sem. 1-6.

Enrollment rules for the next semester as a part of the so-called ECTS credits debt ceiling

The AGH Study Regulations in § 17 specify the rules for enrollment in the next semester of studies within the so-called allowable deficit of ECTS points. The Faculty of Computer Science, Electronics and Telecommunications has a procedure PD - PS - 03 specifying the process of applying for enrollment with a deficit:

<http://www.iet.agh.edu.pl/pl/studenci/procedury/wpis-z-deficytem-punktow/>

ECTS credits debt ceiling

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Organization of classes within the so-called blocks of classes (i.e. such organization of subjects or individual forms of classes that creates exceptions to the cyclical nature of classes in particular weeks of a given semester of studies)

Monitoring semesters

7

Study rules in case of the individual organization of studies approved for a specific student

In accordance with § 9 of the Regulations of Studies at AGH, INDIVIDUALISATION OF THE EDUCATIONAL PROCESS

https://www.agh.edu.pl/fileadmin/default/templates/images/dokumenty/regulamin_studiow/regulamin_studiow_pierwszego_i_drugiego_stopnia_w_agh_pazdziernik_2017.pdf

Implementation of practical placements including monitoring system and completion rules

The conditions for the implementation of professional internships are regulated by the WIET procedure: PD - PS - 16 - <http://www.iet.agh.edu.pl/pl/studenci/procedury/praktyka/> and the syllabus of the subject professional internship. They include criteria for selecting the internship location, the method of documenting the course of the internship and the principles of assessing the achieved learning outcomes.

http://www.iet.agh.edu.pl/files/6715/3630/8630/WZOR_formularz_potwierdzacja_odbycia_praktyki_2017_2018.docx

http://www.iet.agh.edu.pl/files/9115/3630/8531/WZOR_formularz_karta_oceny_praktykanta_2017_2018.docx

Rules of elective modules taking

In the Electronics and Telecommunications major, specialist education is also carried out based on elective modules. Students choose subjects from a list proposed by the research teams of the Department of Electronics, reviewed by the

Faculty Team for the Quality of Education (which includes representatives of the Faculty of Social Sciences and Humanities) and approved by the Dean's Representative for Education. The topics proposed by the research team are related to the conducted scientific activity or the needs of the labor market. Enrollment for elective subjects is carried out for the next academic year before the holidays of the previous year. Due to the limited number of places in elective subjects, the average grade is taken into account when enrolling.

Rules of education paths, graduation paths, major choice/eligibility

Rules related to the preparation of diploma projects and theses as well as the implementation of the degree granting

First-cycle studies in the field of Electronics and Telecommunications end with the student's thesis. It is carried out under the direction of an authorized academic teacher (job supervisor), who defines the mode and schedule of its implementation. The text of the diploma thesis is verified using the Unified Anti-plagiarism System <https://jsa.opi.org.pl>. Supervision over the diploma process is carried out by the Diplomacy Commission appointed by the Resolution of the Faculty Council, its tasks are: approval of the topics of the works, appointment of reviewers and organization of diploma exams. Details of the diploma process are available at: <http://www.iet.agh.edu.pl/pl/studenci/procedury/>, in Resolution 369/2016 RW WIET and in the Regulations of the AGH University of Science and Technology (§ 25 ÷ 27).

Principles for determining the overall evaluation of graduation (the final grade)

The condition for completing studies in the field of Electronics and Telecommunications is:

- 1) obtaining the learning outcomes specified in the study program;
- 2) passing all the modules of classes provided for in the study program;
- 3) obtaining the number of ECTS points required by the study program;
- 4) submitting a diploma thesis;
- 5) passing the diploma exam.

Details of determining the final result of the studies are specified in § 27 of the AGH Study Regulations.

Other requirements related to the implementation of the curriculum resulting from the AGH University Study Regulations or other regulations in force at the University

Additional information please contact:

Faculty of Computer Science, Electronics and Telecommunications

Jacek Kolodziej, Dean for Education

e-mail: jacek.kolodziej@agh.edu.pl

A graduate of the Faculty of Electronics and Telecommunications has knowledge in the field of digital processing and analysis of signals, operating systems, virtualization, programming (Assembler, VHDL, C, C ++, Java, Python), creating web and network applications (also for mobile devices), simulation and design of analogue and digital electronic circuits, radio and fibre optic devices, programming of microprocessors and embedded systems, measurements and validation of devices in the real work environment, signal transmission techniques, Internet networks, mobile networks, Wi-Fi networks, operator networks, network organization and administration rules, communication protocols, traffic engineering, creating virtual networks and cloud computing, network devices (routers, switches, firewalls) and data security.

A graduate of these studies can design electronic systems based on specialized analogue and digital integrated circuits, processors and programmable devices, design network systems designed for various transmission channels and types of data transferred, use measurement tools (arbitrary generators, oscilloscopes, protocol testers, spectrum analysers, measuring cards) and software tools in the process of building electronic and network devices, configure devices (routers, switches, firewalls, virtual networks) and communication protocols in local and wide telecommunications networks, carry out computer simulations of electronic circuits and services in networks, administrate computer networks and diagnose problems of their operation, implement algorithms and build own programs for mobile devices, embedded systems, create websites and network applications, lead projects with planned and agile methods.

The studies allow to undertake education at the second degree studies in the field of Electronics and Telecommunications on one of two diploma paths: Embedded Systems or Networks and Services. Graduates of this course successfully continue their education also in related fields such as ICT or Computer Science studies.

Mentor of the field of study: dr inż. Jacek Kołodziej

[View full description of the field of study](#)

Study programme determined by Resolution No. 110/2019 of the AGH UST Senate of 26 June 2019, changed by Resolution No. 5/2023 of the AGH UST Senate of 1 February 2023